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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 20031218

Application Number: 09/453,831

Filing Date: December 02, 1999

Appellant(s): NAKAMURA ET AL.

DEC 29 2003

David M. Longo
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 10/20/2003.

(1) *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

(4) *Status of Amendments After Final*

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct.

(6) *Issues*

Appellants provided support for the "wherein said solvent consists essentially of water," which overcame the 112(1) rejection of claims 24 and 26. Hence, the 112(1) rejection of claims 24 and 26 are withdrawn.

In summary the issues at hand are

whether a solvent is added to a first polishing liquid for dilution to form a second polishing liquid;

whether the addition of the solvent is carried out upon or immediately before the polishing of the substrate; and

whether a Ru (ruthenium) compound is SrRuO₃. Hence, the appellants' statement of the issues in brief is correct.

(7) *Grouping of Claims*

Appellant's brief includes a statement that claims 24, 26; 11 and 17-21; 12; and 22 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) *ClaimsAppealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) *Prior Art of Record*

4574292	TAKIKAWA ET AL.	3-1986
5407526	DANIELSON ET AL.	4-1995
6143192	WESTMORELAND	11-2000

(10) *Grounds of Rejection*

1. Claims 11 and 17-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Westmoreland (US 6,143,192) in view of Danielson et al. (US 5,407,526).

Westmoreland teaches, a planarizing (polishing) method that comprises:

As pertaining to **claims 11 and 17-21**, Westmoreland teaches, ". . . removing ruthenium metal and/or ruthenium dioxide includes an amount of ceric ammonium nitrate. The material of the invention may be, for example, a solution of ceric ammonium nitrate. The material may be in the form of a liquid etchant solution, and, in one form, the solution may be an aqueous solution wherein ceric ammonium nitrate and,

optionally, other solutes, are dissolved in liquid water" (column 3, line 42-49). Westmoreland also teaches, "In one form, the material of the invention may include about 0.5 to about 70 weight percent of ceric ammonium nitrate (column 3, lines 55-57), which provides evidence that the concentration of material comprising ceric ammonium nitrate is variable and is diluted. Hence the aforementioned reads on,

A polishing method comprising:

preparing a first polishing liquid containing tetravalent cerium ions or cerium (IV) nitrate in a first concentration (wherein the ceric ammonium nitrate is the same as applicant's first polishing liquid);

adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration; and

wherein said solvent has a property of dissolving a solute of said first polishing liquid and does not substantially contain any solute, as in **claim 23**.

Westmoreland also teaches, "The ceric ammonium nitrate material . . . may be used as an active chemical component of a slurry used in a planarization process for planarizing a surface. In such an application, the material . . . is applied to the surface and acts to remove ruthenium metal and/or ruthenium dioxide from the surface that is planarized. The planarization process may be a chemical mechanical planarization process, . . ." (column 5, line 10-20), which reads on,

polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid.

Westmoreland differs in failing to explicitly teach the addition of the solvent is carried out upon or immediately before the polishing of said substrate, **in claim 17**.

Danielson teaches, “An abrasive solution and a oxidant solution are stored separately in containers, pumped into a mixing chamber where they are mixed so as to form a slurry, and the slurry is then immediately used to polish/etch a semiconductor device” (Abstract). Since Danielson teaches a method of preparing an abrasive solution (which comprises a polishing liquid), then mixing the abrasive solution (a mixture of a slurry and a dispersant agent which is typically, water) with an oxidant (same as diluting the initial polishing liquid) to form a slurry (a second polishing liquid), and using the slurry immediately to polish/etch a semiconductor device, then using Danielson’s polishing method would read on applicant’s step of wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate, as in the claimed invention.

Hence, it is the examiner’s position it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Westmoreland by using Danielson’s method wherein said adding a solvent is carried out upon or immediately before the polishing of said substrate for the purpose of creating of slurries which give superior polish/etch rate (Danielson, column 2, lines 7-10).

2. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Westmoreland (US ‘192) in view of Danielson (‘526) as applied to claim 17, and further in view of Takikawa et al. (US 4,574,292).

Westmoreland in view of Danielson differs in failing to teach the Ru compound is SrRuO_3 .

Takikawa teaches, "The atomic ratio M/Ru of Ru and the metal M in the metal oxide film containing Ru and a metal M . . . provides a very stable structure of . . . RuSrO_3 " (column 2, lines 39-45), which reads on a Ru compound is SrRuO_3 .

Hence, it is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Westmoreland in view Danielson by using a Ru compound such as SrRuO_3 as taught by or Takikawa for the purpose of providing a stable structure (Takikawa, column 2, lines 43-45).

3. Claims 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Westmoreland ('192) in view of Danielson et al. ('526).

Westmoreland teaches, ". . . removing ruthenium metal and/or ruthenium dioxide includes an amount of ceric ammonium nitrate. The material of the invention may be, for example, a solution of ceric ammonium nitrate. The material may be in the form of a liquid etchant solution, and, in one form, the solution may be an aqueous solution wherein ceric ammonium nitrate and, optionally, other solutes, are dissolved in liquid water" (column 3, line 42-49). Westmoreland also teaches, "In one form, the material of the invention may include about 0.5 to about 70 weight percent of ceric ammonium nitrate (column 3, lines 55-57), which provides evidence that the concentration of

material comprising ceric ammonium nitrate is variable and is diluted. Hence the aforementioned reads on,

A polishing method comprising:

preparing a first polishing liquid containing tetravalent cerium ions or cerium (IV) nitrate in a first concentration (wherein the ceric ammonium nitrate is the same as applicant's first polishing liquid);

adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration; and

wherein said solvent has a property of dissolving a solute of said first polishing liquid and does not substantially contain any solute, as **in claim 25.**

Westmoreland also teaches, "The ceric ammonium nitrate material . . . may be used as an active chemical component of a slurry used in a planarization process for planarizing a surface. In such an application, the material . . . is applied to the surface and acts to remove ruthenium metal and/or ruthenium dioxide from the surface that is planarized. The planarization process may be a chemical mechanical planarization process, . . ." (column 5, line 10-20), which reads on,

polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid.

Westmoreland differs in failing to explicitly teach the adding of the solvent is carried out upon or immediately before the polishing of said substrate.

Danielson teaches, "An abrasive solution and a oxidant solution are stored separately in containers, pumped into a mixing chamber where they are mixed so as to form a slurry, and the slurry is then immediately used to polish/etch a semiconductor device" (Abstract). Since Danielson teaches a method of preparing an abrasive solution (polishing liquid), mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid) to form a slurry (a second polishing liquid), and using the slurry immediately to polish/etch a semiconductor device, then using Danielson's polishing method reads on appellants' step of wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate, as in the claimed invention.

Hence, it is the examiner's position it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Westmoreland by using Danielson's method wherein said adding a solvent is carried out upon or immediately before the polishing of said substrate for the purpose of creating of slurries which give superior polish/etch rate (Danielson, column 2, lines 7-10).

(11) *Reponse to Argument*

a. Appellants traverse the 103 rejection of claims 11 and 17-21 over Westmoreland (US '192) in view of Danielson (US '526). Appellants argue (see pages 13-15 of Appeal Brief):

the passages in Westmoreland's preferred embodiment, which teaches that the material is "in the form of a liquid etchant solution" (col. 3, lines 46-47) and which "may

be an aqueous solution wherein ceric ammonium nitrate, and, optionally, other solutes, are dissolved in liquid water" (col. 3, lines 47-49) and which the Examiner relied upon to teach the first and second solutions, fails to specifically recite two-solution system and polishing method; and

Westmoreland only refers to only one liquid etchant/slurry solution that may comprise ceric ammonium nitrate and other solutes dissolved in water.

Appellants' argument is not persuasive because one skilled in the art would understand that dilution steps are conventional in preparing final solutions of desired concentrations. Since the reference discloses a solution with a specific amount/concentration of water, it would naturally encompass conventional preparation steps to attain the desired final concentration including the dilution step claimed by appellants. Appellants have not shown any evidence of criticality with respect to their claimed conventional dilution step. As a result, it does not patentably distinguish the claims.

Appellants argue (see pages 15-16 of Appeal Brief) Westmoreland (in col. 7, line 58 – col. 8, line 1) teaches a single bath used for etching purpose and that Westmoreland fails to teach or suggest an effective invention that teaches element of Ru-oxide removal.

Appellants' argument is unpersuasive because Westmoreland teaches, "The ceric ammonium nitrate material of the present invention, whether in solution form or otherwise, also may be used as an active chemical component of a slurry used in a planarization process for planarizing a surface. In such an application, the material of

the invention is applied to the surface and acts to remove ruthenium metal and/or ruthenium dioxide from the surface that is planarized" (column 5, lines 10-16), which suggests that the cerium (IV) solution is also used as a polishing liquid and would be effective in removing Ru-oxide.

Appellants argue (see pages 16-20 of Appeal Brief) the Danielson reference fails to cure Westmoreland's deficiency of the addition of the solvent is carried out upon or immediately before the polishing of said substrate in claim 17 and fails to suggest "Ru," "Ru compound," "cerium," or "ions" anywhere in its disclosure and further argue no suggestion or motivation to modify Westmoreland or Danielson to produce the claimed invention.

Appellants' argument is unpersuasive because Danielson is relied upon to cure Westmoreland deficiency of the addition of the solvent is carried out upon or immediately before the polishing of said substrate. Danielson teaches, "An abrasive solution and a oxidant solution are stored separately in containers, pumped into a mixing chamber where they are mixed so as to form a slurry, and the slurry is then immediately used to polish/etch a semiconductor device" (Abstract). Since Danielson teaches a method of preparing an abrasive solution (which comprises a polishing liquid), then mixing the abrasive solution (a mixture of a slurry and a dispersant agent which is typically, water) with an oxidant (same step as diluting the initial polishing liquid) to form a slurry (a second polishing liquid), and using the slurry immediately to polish/etch a semiconductor device, then using Danielson's polishing method would

read on appellants' step of wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate, as in the claimed invention.

In response to appellants' argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the reason to combine is for the purpose of creating of slurries which give superior polish/etch rate (Danielson, column 2, lines 7-10).

b. Appellants traverse (see pages 23-24 of Appeal Brief) the 103 rejection of claim 12 over Westmoreland (US '192) in view of Danielson (US '526) as applied to claim 17, and further in view of Takikawa (US 4,574,292). Appellants argue the Examiner has failed to show all the elements of Appellants' claims are met in Westmoreland and/or Danielson, fail to show any suggestion or motivation to modify the cited references with Takikawa to result in using a Ru compound such as SrRuO_3 and in Appellants' claimed invention.

Appellants' argument is unpersuasive because Takikawa is relied upon to teach said Ru compound is SrRuO_3 . Takikawa teaches, "The atomic ratio M/Ru of Ru and the metal M in the metal oxide film containing Ru and a metal M . . . provides a very

stable structure of . . . RuSrO₃" (column 2, lines 39-45), which reads on a Ru compound is SrRuO₃. Hence, it is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Westmoreland in view Danielson by using a Ru compound such as SrRuO₃ as taught by or Takikawa for the purpose of providing a stable structure. The motivation to combine is derived the desirability of having a stable structure for the purpose of providing a stable structure (Takikawa, column 2, lines 43-45).

c. Appellants traverse the 103 rejection of claim 22 over Westmoreland (US '192) in view of Danielson (US '526). Appellants arguments (see pages 25-26 of Appeal Brief) are similar to those presented above in (a) with respect to Westmoreland discloses only one liquid etchant/slurry solution that may comprise ceric ammonium nitrate and other solutes dissolved in water.

As stated in (a) above, Appellants' argument is not persuasive because one skilled in the art would understand that dilution steps are conventional in preparing final solutions of desired concentrations. Since the reference discloses a solution with a specific amount/concentration of water, it would naturally encompass conventional preparation steps to attain the desired final concentration including the dilution step claimed by appellants. Appellants have not shown any evidence of criticality with respect to their claimed conventional dilution step. As a result, it does not patentably distinguish the claims.

Appellants argue (see pages 27-30 of Appeal Brief) that Westmoreland (in col. 7, line 58 -- col. 8, line 1) teaches a single bath used for etching purpose and that Westmoreland fails to teach or suggest an effective invention that teaches element of Ru-oxide removal.

Appellant's argument is unpersuasive because Westmoreland teaches, "The ceric ammonium nitrate material of the present invention, whether in solution form or otherwise, also may be used as an active chemical component of a slurry used in a planarization process for planarizing a surface. In such an application, the material of the invention is applied to the surface and acts to remove ruthenium metal and/or ruthenium dioxide from the surface that is planarized" (column 5, lines 10-16), which suggests that the cerium (IV) solution is also used as a polishing liquid and would be effective in removing Ru-oxide.

Appellants argue (see pages 30-33 of Appeal Brief) the Danielson reference fails to cure Westmoreland's deficiency of the addition of the solvent is carried out upon or immediately before the polishing of said substrate and fails to suggest "Ru," "Ru compound," "cerium," or "ions" anywhere in its disclosure and further argue no suggestion or motivation to modify Westmoreland or Danielson to produce the claimed invention.

Appellant's argument is unpersuasive because Danielson is relied upon to cure Westmoreland deficiency of the addition of the solvent is carried out upon or immediately before the polishing of said substrate. Danielson teaches, "An abrasive

solution and a oxidant solution are stored separately in containers, pumped into a mixing chamber where they are mixed so as to form a slurry, and the slurry is then immediately used to polish/etch a semiconductor device" (Abstract). Since Danielson teaches a method of preparing an abrasive solution (which comprises a polishing liquid), then mixing the abrasive solution (a mixture of a slurry and a dispersant agent which is typically, water) with an oxidant (same step as diluting the initial polishing liquid) to form a slurry (a second polishing liquid), and using the slurry immediately to polish/etch a semiconductor device, then using Danielson's polishing method would read on applicant's step of wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate, as in the claimed invention.

In response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the reason to combine is for the purpose of creating of slurries which give superior polish/etch rate (Danielson, column 2, lines 7-10).

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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Examiner
Art Unit 1765

Itue
December 18, 2003

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